THE AMERICAN
X-RAY JOURNAL.

Devoted to Practical X-Ray Work and Allied Arts and Sciences.

PUBLISHED MONTHLY BY THE AMERICAN X-RAY PUBLISHING COMPANY.

HEBER ROBARTS, M. D., M. E., Editor.

SUBSCRIPTION RATES—IN ADVANCE.

United States, Canada and Mexico	$3.00	Foreign Countries	$1.00
Single Copies	25	Single Copies	35

Editorial matter should be addressed to Dr. Heber Robarts, Editor, Suite 301 Chemical Bldg., St. Louis.

All business matter should be addressed to The American X-Ray Journal Publishing Co., same address.

All contributors of original articles and other matter relative to X-Radiance, of interest to the medical profession, are solicited from all parts of the world. Contributors will be furnished a liberal number of extra copies of the JOURNAL containing their articles.

Translation of articles written in German, French and Spanish is made by Frank Ring, M. D., 611 Chemical Building, St. Louis.

Entered at the Postoffice at St. Louis, Mo., as Second-Class Matter.

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Member Roentgen Society of the U. S.
Schenectady, N. Y.

THE AMERICAN
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TO ALL X-RAY WORKERS AND MEMBERS OF ALLIED PROFESSIONS, GREETING:

CEDAR RAPIDS, Iowa, May 6, 1901.

The Second Annual Meeting of the Roentgen Society of the United States will be held at Buffalo, N. Y., on September 10 and 11 at the University of Buffalo. The preliminary announcements will be sent out as soon as possible. A cordial invitation is extended to every x-ray worker, surgeon, physician, dentist, investigator, author on x-ray topics, inventor, skiagrapher or their assistants in hospitals, technical electrician, chemist, teacher of chemistry and physics, specialist and expert in electrology and radiology, etc., whether or not members of the Society, to be present at this meeting. Buffalo, on account of the Pan-American Exposition, is the ideal convention city, readily accessible by railroad from all parts of the United States and Canada. We understand that the railroad rates from all points of this country will be very low. The medical profession of the City of Buffalo is ever alert to make meetings interesting and our meeting, on account of the courtesy of the Dean and the Faculty of the University of Buffalo, will not only be the most scientific and instructive, but will add to the comfort and pleasure of the visiting members, their friends and families. The first meeting of our Society in New York City, was a phenomenal success in every direction. The work of the Society this year, will be again of a high order. Papers are promised by many leading men abroad and from this country, upon a great variety of subjects in electrology and radiology, both practical and theoretical, and any x-ray worker attending the meetings, will be fully paid in the information received. There will be offered advantages to the visiting members at our meeting for instructions in the x-ray work, that cannot be had under any other conditions. The Society earnestly hopes to have an exhibit of every part of x-ray apparatus of all makes, and complete assortment of skiagraphs of actual cases. The reports of the special committees, especially on standards, will be most interesting and instructive in a legal way and the success of the work of those at the head of our beloved profession, depends mostly on the cordial co-operation of every x-ray worker, every profession devoted to this branch of science and every maker of x-ray apparatus in this country. The membership of this Society ought to be greatly increased, when we consider that there are many yet outside of the Society, many of those who are diligent and honest in their purpose to help to relieve suffering and when possible to prolong life. This proves that much yet remains to be done in increasing this great agency for good. The meeting in Buffalo will be the proper stimulus. The social features of the meeting will not be neglected. The busy members and our friends will find the few days spent at

the meeting not only instructive, but restful, in meeting our confreres, and at the Pan-American Exposition, an opportunity to study the great achievements of the science in all other branches.

Aside from the scientific and social features, there are matters of business to be considered, well worth the attention of every x-ray worker, matters affecting the welfare of every branch of our profession. We hope, therefore, that every man working with the x-ray, every friend of this new method of diagnosis, every honest worker of the science, will make an earnest effort to be present at the coming meeting.

In regard to exhibits, write to R. C. Adams, Secretary of the Committee on Arrangements, Drawer 963, Buffalo, N. Y.

To promote harmony in results and secure accuracy and give legal value to the x-rays, the Committee on Standards accepts gladly any device or report. The Chairman of this Committee, Dr. S. H. Monell, 47 West 27th St., New York City, invites all x-ray experts to make suggestions and contribute to the general good of the cause.

Applications for membership must be accompanied by $5. There is no initiation fee. The official organ, THE AMERICAN X-RAY JOURNAL, free. For particulars write to the Secretary.

J. RUDIS-JICINSKY, M. D.
Cedar Rapids, Ia.

X-RAYS WITHOUT ELECTRICITY.

It was announced last week at a sitting of the Paris Academy of Science that H. Curie, a chemist, had separated a new gas from radium. This gas is intensely phosphorescent and will glow for months in the dark. It was also announced that M. Nandon, a scientist, had found means of producing x-rays without electricity by exposing a metal plate to the rays of the violet end of the spectrum.

OBSERVATIONS ON CROOKE'S TUBES. ETC.

BY H. WESTBURY.

Read before the Roentgen Society of the United States, Grand Central Palace, New York City, Dec. 14, 1900.

[CONTINUED FROM PAGE 878.]

The Crooke's tube is quite as important as the apparatus in the production of x-rays, as at the present time it is the only practical way of producing the rays for medical use. Such tubes are, generally speaking, made of flint glass, although lead glass can be used, but is more opaque. Originally it was laid down as a fact that lead glass would not produce x-rays at all. Ordinary ruby glass is also opaque to the rays, and it appears that the rays will not pierce certain colors. The red-tinted glass used in some English tubes is not ruby glass but simply due to minerals in the glass not necessarily opaque to the rays. It is extremely interesting to watch closely the vagaries of various tubes after re-exhaustion on the pumps. Some will fluctuate in vacuum, one minute going very high and the next so low that no rays are generated. These fluctuations can sometimes be driven out of the tube by heating the anode to a white heat and then allowing it to cool off before again repeating the process which we call "curing" a tube. All the best vacuum tubes are treated in this way, as it has been found by experience that tubes exhausted too high on the pumps never give the results obtained from tubes taken off at a lower vacuum and then electrically cured. If I remember correctly our friend Dr. Rollins has demonstrated this fact in his interesting notes on x-light. Other tubes behave very curiously. Some will throw a peculiar patch of fluorescence in certain parts of the tube; others will be of high vacuum and give a reversed current, and the other week I even obtained a German tube with an aluminum ring in the

center, which, after re-exhaustion, gave a reversed current at a very *low* vacuum; a phenomena I have never observed before. It is no exaggeration to say that no two tubes behave exactly alike, although, of course, tubes can now be made so uniform as to lead any outsider to believe there is no distinction in them at all. There is quite a difference of opinion as to the correct situation for the cathode, whether just inside the bulb or inside the terminal, and this difference seems to have been in existence for several years, as I remember reading an article two or three years ago claiming that the cathode inside the bulb was of no use for coil tubes, but immaterial for static current. Personally I have failed to find much variation, and am inclined to think that within reasonable limits any size cathode and any position gives about the same results, but at the same time I believe that a good deal depends upon the concavity of the cathode, and, of course, liability to puncture has to be considered in placing the cathode, more especially on a static tube. Theoretically, however, while it is probably true that a focus right on the center of the anode is best, yet the benefit obtained is so small that so long as the cathode stream impinges on some part of the anode disc x-rays are present in abundance. Sometimes one gets an old tube with the anode twisted and bent out of all shape, and even with a hole right through it, which yet gives magnificent results. Another curious phenomenon is the peculiar blackening of the glass bulb after continual use. Many explanations have been brought forward to account for this discoloration, but so far none of them seem plausible, and probably until we solve the exact nature of the rays themselves we cannot tell what causes this deposit on the bulb. One thing I can say, however, that tubes giving fine phosphorescence blacken less than others. It used to be considered that the more phosphorescent a tube was the better x-rays it would generate, but this cannot be proved, as I have many tubes with little or no phosphorescence giving as good results as those made out of the most luminous glass. This luminosity is also a very curious phenomenon. Sometimes it appears evenly all over the bulb, the glow lasting for a considerable time after the current is turned off. Sometimes it is only present in small portions of the bulb, and occasionally I have seen it represented by simply a luminous shadow of the anode thrown on the otherwise black wall of the tube. To the outsider the evolution of the present perfected form of Crooke's tubes from the type originally used shortly after the x-rays were discovered does not present very many features striking to the eye, but to those who have been closely following these changes they have improved very steadily every year. The original types of tubes were of the kind in which the cathode stream of rays was thrown on the glass of the tube itself. While this type of tube was at first successfully used, the necessity for a tube which would focus the rays soon became apparent. After numerous experiments with various contrivances for attaining this result tubes were produced with aluminum cathodes and platinum anodes, and these have held their ascendancy up to the present time. Since that date constant experimenting has led to something approaching a standard shape for Crooke's tubes. The bulb was gradually changed from the oval and tubular shape to globular, although some of the very earliest types were made spherical. The distance between the anode and cathode with which the best results could be obtained was gradually determined. The terminals were extended to meet the increasing efficiency of the apparatus used for the excitation of the tubes, which caused

the current to spark across, and many minor details in connection with the sealing in of the terminals and proper supporting of them to enable a tube to be transported without danger of breakage were made. Of recent date we have the reinforcement of the anode with other metals to enable it to stand up against the heavy currents now used, and the endeavors to focus all the rays in a circle on the front wall of the tube so that none of them may be useless by passing out where they are not required. One of the earliest troubles met with in tubes was their tendency to gradually increase in vacuum, until at length they became so high that the current would not pass through them, and even if an enormous spark were used the resulting rays were so highly penetrating as to be of no practical use. This led to the devising of the adjustable vacuum feature, which is now so prominent in most tubes sold in this country. Originally ordinary potash was used enclosed in a small auxiliary tube and liberated by means of applying a match or Bunsen Burner. This lowered the vacuum certainly, but only for a few minutes, when it jumped up again as high as before. Many operators also cracked their tubes, owing to heating the auxiliary tube too much, and many present will remember the burned fingers which sometimes resulted. To meet this difficulty, the present types of adjusters were designed with a wire terminal, so that an electric spark can be discharged directly through the auxiliary tube, and better salts and combinations were obtained which regulate the vacuum a great deal better than formerly, but, of course, this is not yet by any means perfect.

Both osmium and iridium have been used for the anode, but both of these metals generate so much gas that it is very difficult to exhaust a tube containing them, and even then after use such a tube will continually run too low for the production of rays, in addition to which the cost is prohibitive for a commercial tube. I am inclined to believe that for some of the finer forms of x-ray work the tubes with water cooled targets may prove useful, but unless such a tube can be designed much cheaper than at present their cost is also prohibitive. I think it can be readily understood that the market for a $30 tube is a very restricted one when a really good tube can be obtained for a third of that price.

I particularly wish to bring before this meeting one point which I very much desire to impress upon tube purchasers generally, and that is the advisability of our trying to standardize American glass for Crooke's tube use. There is unfortunately at the present time a color fancy among many Crooke's tube operators who insist upon having tubes which give an apple green effect. Now it is a fact that this has nothing whatever to do with the strength of the rays given out by such tube, and tubes made of American glass giving a whitish or yellowish color illuminate a screen just as brightly as one made from the best green German glass. My reasons for raising this point apart from the patriotic one of using home-made materials, which, however, ought to have a little weight, are that the domestic glass is as a rule stronger and freer from blisters, cords, air bubbles, etc., which tend to make a tube liable to puncture and also, which I think is the most important reason for purchasers of tubes to consider, much more easily repaired. I think I can claim some little knowledge in this respect, and I unhesitatingly say that I have not yet seen a German tube which could readily be repaired without fear of the glass going to pieces on the pumps. There is something used in the glass which makes them particularly fragile when attempting to re-exhaust them, and in consequence of the defects, such as air bubbles, etc., as

fast as one puncture is repaired another breaks out. On the contrary, with tubes made of the best domestic glass they can be repaired time and again indefinitely without trouble and are as good as new, and the cost of such repair is, of course, much less. Taking these points into consideration, I think it is quite time that users of Crooke's tubes understood that color to the eye means nothing and that what they want to get is, other things being equal, tubes which will be durable and, if punctured, such as can be repaired and made as new at the least cost. I am not in favor of using a larger bulb for a Crooke's tube than about 5 inches, as I do not think that there is any better definition or even field obtained by using larger bulbs. Of course, for very heavy sparks an 8 or 10 inch bulb is probably an advantage.

An interesting experiment with the double focus tubes on alternating current is to run them in multiple series, which can easily be done by wiring each of the two cathodes together. Of course, the field is somewhat enlarged, but as I have never taken a large radiograph this way I cannot say whether this arrangement is of much practical use. In multiple they do not run so well, and with single focus tubes, as a rule, there is no benefit obtained by using more than one tube at a time.

The use of a very high vacuum or "hard" tube is of very little practical utility, as, while the rays are enormously penetrative, the definition obtained is not distinct or clear, and for very delicate work, such as observing the lungs, etc., the definition has to be as clear as it is possible to obtain.

Dr. Lenard, of Philadelphia, has recently done some excellent work in the line of penetrating the inmost recesses of the organs and I have several times verified his published statements. The following is, therefore, interesting:

In cases of calculus a soft tube is required, as the rays must differentiate between the shadows of tissues less dense than the least dense calculus, and all calculi can be found. A soft tube is one having a low vacuum and best results are obtained from such a tube with a large volume of Roentgen discharge. For lumbar and pelvic pictures the vacuum requisite is equivalent in resistance to from one to two inches of spark in air as measured by a parallel spark gap. High wattage and not high voltage seems to be the necessary element in the current employed to energize a tube in such cases. Great difficulty is met with in obtaining such volume to penetrate these thicker portions of the bodies unless a regulating tube is used, which permits the required volume of electrical energy to be forced through a tube without altering its resistance eliminating the effect of heat, which in a soft tube either lowers the vacuum until it loses all penetration or highers it rapidly until the penetration is too great. It is this inherent tendency of a regulating tube that has been highly exhausted to regain its high vacuum after it has been lowered that makes it superior to an already soft tube that has never been high or hard. The vacuum of an initially soft tube will not remain steady while energy sufficient to develop the required volume of Roentgen discharge for soft tissue work is forced through it.

The subject of x-ray burns is to be treated in a special paper to be read at this meeting, but while the cause of them is still in dispute, I would like to state that I believe, in common with several other observers of tube phenomena, that they are only caused by certain tubes and that the trouble is in the tube itself, at what point I cannot, of course, say, but I firmly believe that there is some little difference which causes the rays to burn, or, more properly speaking, causes dermatitis. However, militating against

my theory to some extent is the fact that Dr. Scott and other operators have found that the funnel focus type of tube which probably focuses more of the rays on one spot than any other type of tube, causes dermatitis after very short exposure, which would tend to show that the old theory of the more powerful the rays the more the tendency to burn is incorrect. I appreciate that there are probably a number of gentlemen present who are desirous of obtaining all the points they can on the methods of operating Crooke's tubes. I, however, feel that such hints can best be supplied by the various manufacturers exhibiting apparatus, each of whom can demonstrate such methods in connection with their own special apparatus and Crooke's tubes so as to be necessarily a great deal clearer than any advice I could give in a paper of this kind. I will, therefore, leave these questions open for demonstration on the machines during the meeting, but I would impress upon the amateur users of tubes the advisability of learning all the points they can on this subject, as it will preserve them from probably much expense in both punctures and patience if they understood thoroughly how to manipulate a tube correctly on their own type of apparatus, whatever that may be. One trouble is that a physician will purchase a set of x-ray apparatus and tubes and proceed to manipulate them without any real knowledge or care of the tubes. Everyone who starts on x-ray works should consider that it takes more than a few weeks practice to understand enough to do first-class work, a condition not always arrived at in a year. One of the objects of this Society is to disseminate knowledge amongst its members and aid them to a practical understanding of x-ray work. Personally, I shall always be very pleased to do what little I can to answer any queries on tubes or their behavior which members may wish to be informed upon, and I trust they will not hesitate to write me at any time on this subject.

In closing, I can only say that I sincerely trust to see very shortly every member of the medical profession recognizing the necessity of keeping up with the times and taking up x-ray work as a needful adjunct to his practice.

Harrison, N. J.

SKIAGRAPHS ADMITTED IN U. S. COURT.

In the United States Federal Court on April 9, at Chattanooga, Tenn., Skiagraphs made by Prof. Horner, of Cleveland, Tenn., were admitted and ordered by the court to be shown to the jury. The point was hotly contested. It was a $10,000 damage case by Mrs. Stinnett against the Southern railway. The Skiograph revealed the healthy and injured sides of the body, a precaution which should always be taken if the case is to be medico-legal.

ACCURATE LOCALIZATION.

Dr. John Macintyre in his presidential address before the Roentgen Society, of London, said:

"The demand for accurate localization of foreign bodies and fractures, which is an absolute necessity, has been well answered in the form of practical methods based upon theoretical considerations previously demonstrated."

What do the surgical teachers and writers think of this saying, before a learned body, when they themselves have written upon the "inaccuracies of the x-rays?"

G. Wilbert made examinations of different drugs with the help of the x-rays and recommends the application of the same in all those cases where the microscope or the chemical analysis remains negative. The x-rays tell at once and without much trouble, if Aloe, for instance, contains any sand or not or if asafœtida was a clear and real article, etc.

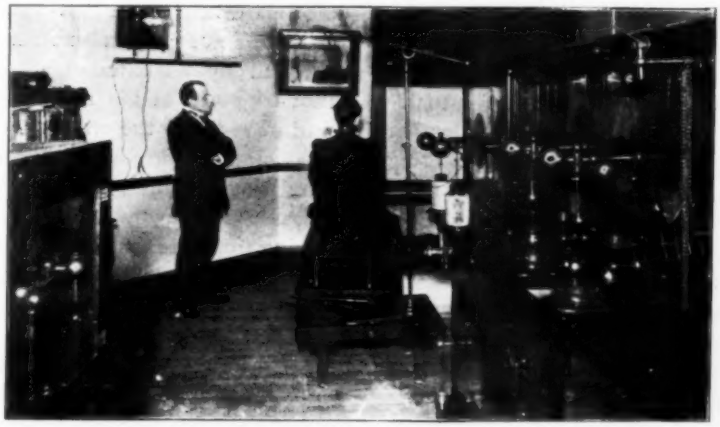
A STUDY OF STATIC ELECTRICAL APPARATUS.

BY JOHN TOWNSEND PITKIN, M. D.

ARTICLE NO. 2.

Adventitious Plates.

In the short article of last month was briefly considered the oil immersion of the Leyden jar; the same subject will receive a little elaboration before passing to the digestion of other important improvements in static electrical apparatus.



CORNER IN A STATIC ROOM.

Showing the Pioneer Twelve and Eighteen (revolving) Plate Holtz Machines.

PITKIN AXJ MAY 1901

The functional activity of immersed condensers may be facilitated by lining the bottom of the inside of the retaining vessel with a metallic plate or employing a shallow substratum of water as an electrifiable surface. The discharging rod or chain requires insulation to overcome the tendency to electrical loss and prevent contact with the glass surfaces of the jars; otherwise there is imminent danger of their being punctured by disruptive action, the glass fractured and the condenser ruined. It may be observed that through the employment of the oil bath as recommended the capacity of the condensers will be augmented, as is evinced by the brightening of the flash, heavier detonation, fattening of the spark and increased resistance to the mechanical propulsion of the apparatus. Stoppers of the Leyden bottles should be made of leather, glass, hard rubber, parafine, sealing wax or some other dielectric. Wood is too good a conductor of high tension currents to be employed in the construction of any portion of a static condenser. From either extremity of the static machine, extending a variable distance towards, and at the same elevation as the axle, between the alternate interspaces of the revolving wheels, firmly placed upon metallic supports, are the collecting rods and combs. The combs receive the electromagnetic energy from the revolving discs, the rods maintain the combs in position, and through co-operation with the fellows of the opposite side and the intervening air functionate as the electrified metallic surfaces of Leyden jars. It becomes apparent that the apparatus which we have considered as one large self-exciting condenser, is in reality formed of many small units, and that, while in action, the static machine becomes a row of Leyden jars operating and connected in simple multiple rela-

tionship to each other. In a well constructed machine these jars or segments are of uniform composition, symmetrical in arrangement, perfect in alinement, and of equal capacity; they unload themselves *in toto* through an outside condenser, consisting of the prime conductors, discharging rods, the surrounding atmosphere, and intervening air gap. If the discharging rods are slowly drawn apart the row of condensers will gradually accumulate more and more load, the number and strength of the bisecting lines of magnetic force increase, the strain upon the dielectric air between the sets of comb-holders of opposite sides becomes so great that it eventually gives way within the case, the collecting rods become vicarious discharging structures, and the apparatus is more or less completely short circuited.

The breaking down or magnetic point of saturation of the atmosphere will vary with (1) insulation of the axle, (2) amount of moisture in the air, (3) width of opening or interval between the revolving wheels, (4) the presence or absence of spark gaps or Crooke's tubes in the external circuit, the length of the former or the resistance of the latter, (5) intentional or accidental charging of sursounding objects in and of the apartment, (6) number and size of plates, (7) speed.

The condenser action and currents strength is necessarily very low in machines having wooden collars between the revolving discs, the woodwork forming a pathway for luminous convective discharges. It is obvious that such machines are not suited for the best x-ray work, because a tube of high vacuum requires a *strong* high-tension current for its *full* excitation.

With solid hard rubber washers on an axle clad throughout (except in the bearings) with sleeves of the same material, the capacity of the air and hence of the entire machine is much greater, and the electrical output is proportionately intensified.

One of our recent static machines built for practical and experimental purposes was exhibited by the makers to the members of the Roentgen Ray Society of the United States, held in New York City December 14, 1900. This apparatus has eighteen (18) revolving plates thirty-two (32) inches in diameter or ten condensers in accurate alinement. The axle has a hard rubber sleeve and massive collars made of the same material*. The air space into which the posterior comb-holders extend is limited by an extra or adventitious stationary plate, and is made to correspond in width to the other spaces used for a similar purpose. Because the neutralizing rod and posterior portion of the case are beyond the extra plate sparking from the collecting combs and rods to these structures is rendered impossible.

As the anterior space of the machine proper, where the first set of collecting combs functionate, is only limited by the front of the case, this space takes up a surplus magnetic charge during functional activity of the machine, and with a fifteen-inch spark gap, or a hard tube of equal resistance in series, disruptive discharges take place between the anterior set of collecting comb-holders. The remedy for this condition should be self-evident. A supernumerary revolving disc inclosing the anterior set of rods, so as to reduce their interspace to the diameter of the others employed for the same purpose will overcome the inequality. The strength of the entire set of condensers will then be perfectly balanced as a consequence of their having become of uniform capacity.

*For a specimen of radiographic work of this machine see March issue of the JOURNAL.

Buffalo, N. Y.

STATE COLLEGE OF KENTUCKY,
DEPARTMENT OF PHYSICS.

LEXINGTON, Ky., Feb. 25, 1901.

Dr. Heber Robarts, Editor of The American X-Ray Journal, St. Louis, Mo.

DEAR SIR:—I have on several occasions used the following method of locating a bullet in x-ray work and with perfect success. Suppose the bullet to be embedded in the back at some point, K, Fig. 1. First locate it approximately with fluoroscope or by photo. Then attach a small shot to the skin at some near point, A. It will do just as well to put the shot at K, directly over the bullet. Next fasten a small triangular piece of lead to the film side of the photo plate at some point, A, Fig. 3. Now place the tube stand, holding the tube in position on the table and place the plate underneath with the marked point A, vertically under the x-ray source. Note the position of the stand, then remove it. Place the patient in position on the table and on his back, with the shot directly over the triangular piece of lead, being careful that the plate is not moved. Replace the tube stand in its first position on the table. The tube will now be vertically over A, Fig. 2. Make the first exposure to the x-rays. Then slip the stand about four inches, until the tube is over some point, B. Make the second exposure. When the plate is developed it will show the points marked by the shot and bit of lead at A, Fig. 3, and the two shadows of the bullet at C and D. With the film side

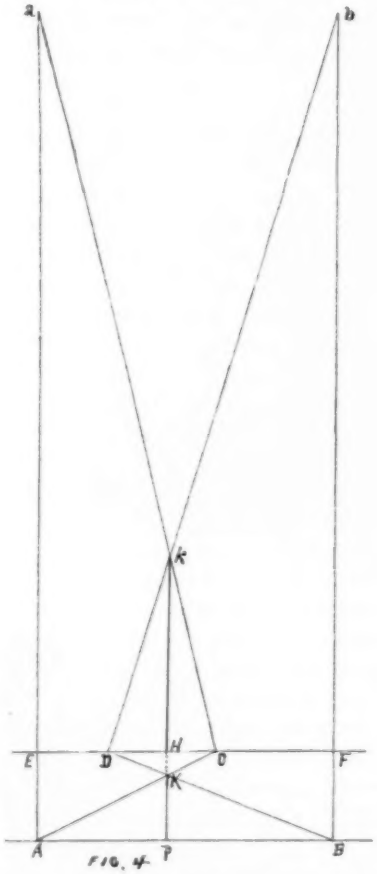


FIG. 4.

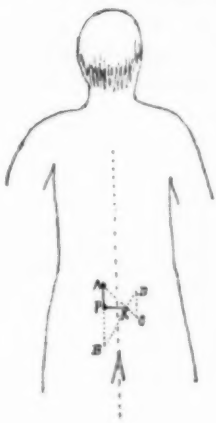


Fig. 1.

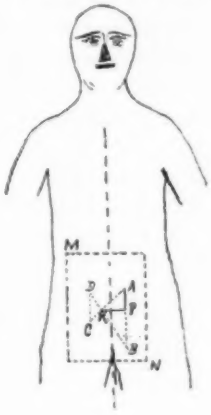


Fig. 2.

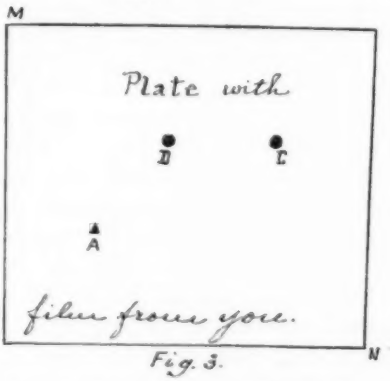


Fig. 3.

of the plate from you, transfer the three shadow points A, C and D, to a drawing board, Fig. 4. On the board draw a line through D and C. Draw a line through A parallel to D C, and on this line mark the second position of the tube at B. A B is the distance the tube is moved. At A and B erect perpendiculars Aa and Bb, and on these lay off Ea and Fb equal to the distance of the tube from the plate. Join A and C, B and D, a and C, b and D, and through k and K draw kP. K shows the position of the bullet in plane k in elevation, and kH is the distance of the bullet from the plate. Lay off the lengths AP and PK on the patient's back, Fig. 1. The point K will be directly over the bullet. The depth of the bullet will be kH, or kH less by the distance the point K on the skin is from the plate. I first used this method last October. The patient had been shot in the back about twenty years ago. I first found the bullet with the fluoroscope, but could not see it latterally so as to get its depth. When a plate was exposed as above and developed, it showed that the bullet had split into two parts, each piece giving a double shadow. One plate located both pieces simultaneously. One piece was removed next day.

To use this method successfully it is best, perhaps, that the operator should have some knowledge of Descriptive Geometry. The method is very accurate in both theory and practice. A high vacuum tube should be used and each exposure may range anywhere from two to five minutes.

I use an induction coil giving a 15-inch spark, and seldom fail to locate a bullet with the fluoroscope alone.

M. L. PENCE.

[We very much appreciate the mechanical exactness Prof. Pence has found in locating foreign bodies. But with full credit given we can not see why the always ready fluorometer should not take the place of this or any other method thus far given. The fluorometer is always ready, simple to use and accurate in results.—ED.]

ROENTGEN SOCIETY OF THE UNITED STATES.

ANNOUNCEMENT OF COMMITTEE ON ARRANGEMENTS.

The Committee on Arrangements for the next meeting of the Roentgen Society of America have secured, through the courtesy of the Dean and Faculty of the University of Buffalo, the use of as much of its building as we may require. The location is central, the room ample and on the ground floor. The date of the meetings will be Sept. 10 and 11 at the University of Buffalo, Buffalo, N Y.

The following rules and regulations in regard to exhibits have been adopted by the committee: Applications for space should be sent as early as possible to R. C. Adams, Secretary, drawer No. 963, Buffalo, N. Y., with particulars as to character of exhibit and space needed.

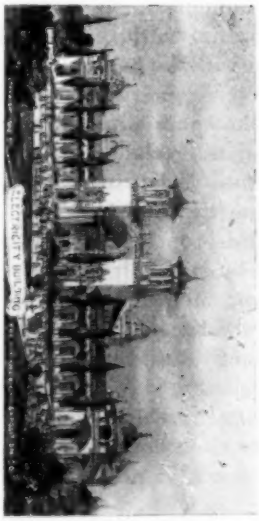
Exhibits may be consigned to Louis Staffeldt, care University of Buffalo, and all express and freight charges must be pre-paid. Owners of goods sent by freight who wish them transferred to place of meeting on arrival, must notify the secretary and send him the pre-paid bills of lading. The cartage will be at expense of owners.

Exhibits are wholly at risk of owners, and should be unpacked and installed by them not later than Sept. 7.

Alternating current 104 volts, single phase, 60 cycles, and direct current 110 volts, will be available, also dark room for photographic purposes. All exhibits must be removed by Sept. 13.

EDGAR B. STEVENS, Chairman.
ROGER COOK ADAMS, Sec., Drawer 693.
DR. JAMES W. PUTNAM,
DR. ELMER E. STARR,
DR. RENNICK R. ROSS,
Committee.

A GLIMPSE OF THE PAN-AMERICAN EXPOSITION.— PERGOLA AND ENTRANCE TO MIDWAY.



SOME HINTS FOR X-RAY WORKERS.

BY BENJ. F. BAILEY, M. A.

(CONTINUED FROM PAGE 882.)

The tube is connected as usual, with the discharge rods of the coil and the connections made with the mains as before described. The platinum point is arranged so that only a small portion of it extends into the liquid. The switch is then closed and the point screwed down until the tube attains the desired degree of radiation. The spark length required is generally not great, as a six-inch discharge from the Wehnelt Interrupter will light up a tube that will not yield to a 12-inch discharge produced in the ordinary way. Very few of my exposures, even of thick parts of the body, require more than five inches of spark length. A very practical result of this is that a small coil will do the work, usually requiring one several times as large.

To use the full power of a large coil it is necessary to use a tube made especially for this purpose. These are usually made with an extra heavy anode, and with some arrangement for carrying off the heat generated there. A tube of this type is shown connected up in Fig. 3. (See page 880.)

RADIOGRAPHY.

The greatly increased brilliancy and penetration obtainable with the Wehnelt Interrupter, brings up considerations concerning the proper degree of radiation, which do not so strongly present themselves when the ordinary interrupter is used. Some writers seem to think that a tube can not be too bright; that the stronger the radiation the better the picture that can be made. This is all wrong. Any one having even a moderately powerful outfit, can convince himself of its falsity. Let him put a large bone button in a purse and observe it through the fluoroscope. With the tube giving off a feeble radiation the outlines of the purse can be seen, but no trace of the contents. On increasing the current the button will appear with the outline of the purse still evident. A further increase of current will cause the leather of the pocket book to disappear, the button still remaining black and distinct as before. If the radiation be pushed to the highest possible point the shadow of the button, even, will fade away.

An x-ray outfit is not necessary to demonstrate this point. A gas jet, a piece of window glass and a wall are sufficient. Holding the glass near the wall with the flame turned very low, nothing can be seen. With a small flame the shadow of the glass becomes distinct, but on turning on more light it will completely disappear. The analogy is perfect, as an x-ray picture is merely a shadow picture.

We have then, four distinct stages, which, however, merge into one another, and the one we would pick out to photograph the pocket book would depend upon what we wished to show. The first and the last would rarely be used. The second stage would be employed to show folds in the leather of the pocket book; the third, if the outline of the button were wanted.

With a powerful outfit this same thing can be shown with the hand. If a picture is taken with such a powerful radiation that the bones appear white and transparent, it is evident that the picture will be entirely lacking in contrast. Shortening the exposure does not remedy this. The proper degree of radiation is found by gradually increasing the current, keeping the fluoroscope at the distance at which it is desired to take the picture, until the flesh seems to drop away, leaving the bones as black as before. Anything more than this will show too little bone, anything less, too much flesh.

The presence of a bullet or other

piece of metal in the bone itself would modify this. Here it would be advisable to use a much stronger radiation, to show the contrast between metal and bone, instead of between bone and flesh.

On the other hand, if we wish to show the presence of a growth of only slightly greater density than the flesh, the radiation must be much weaker, the adjustment must be carefully made to get any contrast, and the exposure must be short. Fig. 5, which is a picture of the heart in a living subject, is of this class. Here the radiation used was certainly not over half the maximum obtainable from the tube. The distance from tube to plate was 14 inches, and the exposure only two minutes. The Wehnelt Interrupter was used with the direct current. This is without the use of the screen, as are all the exposures given here. The contrast is excellent. The heart is seen near the center of the picture. The edge is, of course, blurred on account of the heating. The diaphragm shows in the lower right-hand corner, but is, of course, blurred also. The ribs, which show, are on the back of the body, while the plate was at the front. They show very good definition, considering the distance they were from the plate.

In photographing the knee joint, shoulder, pelvis, etc., a much stronger radiation may be used, as the lines here are thick enough to cast decided shadows even with the strongest obtainable radiation. There is little danger of making the exposure too long. The picture of the shoulder, Fig. 6, is of this class. The exposure was three and one-half minutes at a distance of twelve inches.

EXPOSURE.

A great deal of misunderstanding exists in regard to exposure. I believe that there is a definite limit to shortness of exposure and that in many parts of the body this limit has been reached. Some comparisons with ordinary photography make this clearer. As is well known, in taking an ordinary photograph, the exposure may vary within very wide limits. I have developed a picture which was accidentally exposed about one hundred times too long and secured a fair negative, and on the other hand almost all snap shots are under exposed. In x-ray work no such latitude exists. An exposure must generally be within twenty-five per cent of correct to obtain a picture worth much. There must be a fundamental difference between the two processes. I think it is this. The x-ray picture corresponds to a *print* taken from an ordinary negative, the object photographed taking the place of the negative, and the x-ray light being used instead of ordinary light. In making a print the exposure must be just right, so also with the x-ray picture.

The analogy holds in other ways. The skillful photographer prints his weak negatives by weak light, and uses direct sunlight for dense strong negatives. The importance of the same thing has just been pointed out for x-ray work. What we wish to obtain in our negatives is, primarily, contrast. In taking a picture of a hand, for example, the plate outside the hand should be decidedly black, the flesh almost as dark, and the part under the bones comparatively elear. Now what we want is just enough exposure to blacken thoroughly the exposed parts of the plate. If the radiation is of the proper intensity, as has been explained, a good negative will be secured. The bones will show clearly and the flesh will be penetrated rapidly so that it barely shows. Less exposure than this fails to blacken the "high lights" properly, more causes the part under the bones to be affected too much and contrast is lost.

With this understanding we get a new light on the subject of short exposures. The only way to shorten the exposure is to increase the radiation, but this corresponds to a photographer using very

thin negatives and exposing in a strong light so as to make his prints more rapidly. In each case, there is a happy medium which must be used to get the best results. It is entirely possible to take a picture of the hand in ten or fifteen seconds, but the picture lacks contrast. If, on the other hand, the tube is so dim that it requires five minutes exposure the flesh will show too strongly and there will be no detail in the bones. If the radiation is at the best point, a hand will acquire one to two minutes.

It will be seen that no mention is made of the distance. This takes care of itself. If the radiation is right it does not matter how it is obtained, whether by varying the current used or the distance from tube to plate. The law of squares does not hold in the sense that we can double the distance, expose four times as long and get the same kind of negative. In the mere matter of blackening a plain plate, it doubtless does hold.

In photographs of the knee joint, pelvis, and such parts where the thickness of bone is great compared with the thickness of flesh, we may use the most powerful radiation and give long exposures, as the bony parts are penetrated very little. This is, of course, assuming that it is the bony structure that we wish to show. If a tumor or other soft part be the thing we wish to get on our plate the radiation should be weaker and the exposure shorter. I have made a good radiograph of a growth that did not show at all with the fluoroscope. On the other hand, to show a bullet embedded in the bones of the knee we could hardly expose too long or use too strong a radiation.

Good pictures through the chest are hard to obtain, because the thickness of the ribs and other bony parts is slight compared with the thickness of flesh. An under or an over exposure here will spoil the picture. In x-ray pictures of small animals the radiation must be weak and the exposure fairly short.

In any x-ray work the tube should be at least as far from the plate as the diagonal of the plate. There are two very good reasons for this. There is always some distortion in a radiograph and this becomes very marked if the tube is near the plate. In the second place, if they are too near together, the distance to the center is much less than to the edges. The amount of radiation varies inversely as the square of the distance and this causes the edges to be very much less exposed than the center. Moreover, the rays striking the edges and corners, do so at an angle from the perpendicular, and the radiation must be multiplied by the cosine of this angle to get the useful effect. Making this out for the case when the distance is equal to the diagonal of the plate, we find that the corners receive only 72 per cent of the radiation at the center. If we double the distance, the proportion increases 90 per cent. It will be noticed that the bone of the arm is less clearly defined at its corner end than higher up. This is due to the smaller amount of radiation received at the edge of the plate.

DEVELOPMENT.

This is too large a subject to treat here, and the process can be found described in any manual of photography. The ordinary method is used except that a large amount of restrainer (K. Br.) is used so that the development is slow, frequently taking twenty minutes or more. If possible an operator should do his own developing, as he can in that way more readily tell where he has made his mistakes. He also knows the conditions under which the exposure was made, and can regulate accordingly.

I should strongly advise any one who has access to a commercial circuit to try this method, particularly if alternating current is available. It will increase the output of a coil many times.

Ann Arbor, Mich., January 4, 1901.

THE COIN-CATCHER.

In the grand old *Medical Record*, March 16 ult., there is an article by A. E. Isaacs, M. D., entitled, "A Whistle

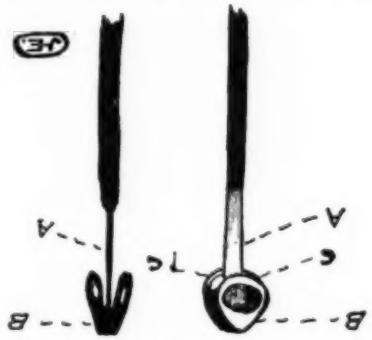


FIG. 1.

in the Esophagus." We are very sorry that Dr. Isaacs and Dr. King, to whom he refers, were not close readers of THE AMERICAN X-RAY JOURNAL. If they had been, great suffering and surgery would have been spared one patient, delay and anxiety in the other and space occupied in the *Record* for a more instructive article.

In an original article which appeared in THE AMERICAN X-RAY JOURNAL, Vol. 6, No. 2, Feb., 1900, by Dr. John Hall-Edwards, Birmingham, Eng., drawings of the Coin-Catcher and its application were diagramatically given. We reproduce the cuts here for the benefit of the newer readers.

The Coin-Catcher, Fig. 1, is absolutely certain to achieve the results for which it was designed if properly used. It consists of a whalebone stem, in the ends of which is fixed a piece of watch-spring, A. On the ends of this, on a loose hinge, is fixed a miniature anchor, which moves freely from one side to the other. When this is passed down the gullet, which contains the coin, and passed through the obstruction, one of the free arms (cc) pass beneath and behind the coin, so that when the instrument is

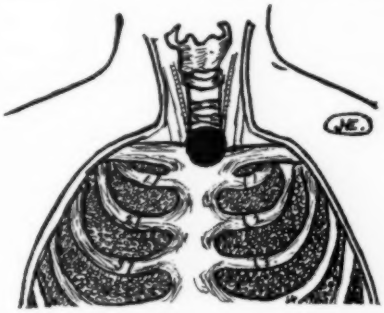


FIG. 2,

withdrawn one arm grips the coin and brings it up. Fig. 2, shows the method in which the instrument acts. A, coin-catcher. B, coin.

The reason the coin-catcher fell into disuse is that so little discomfort followed

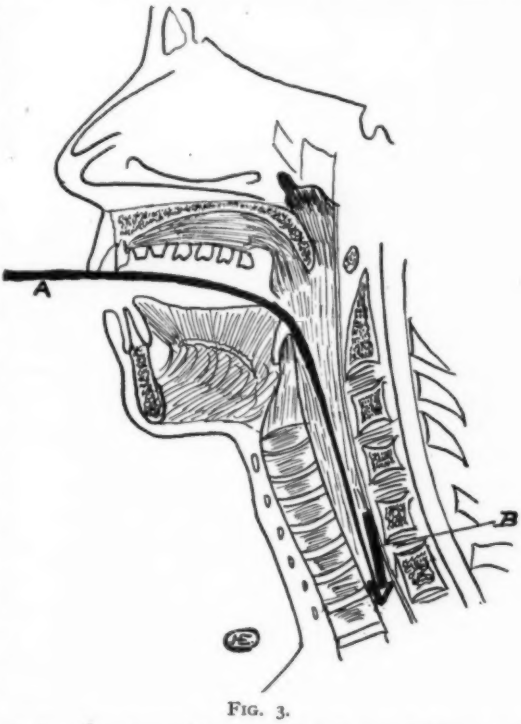


FIG. 3.

the immediate swallowing or lodgement of the foreign substance that it was believed to have gone into the stomach.

In about every instance the coin is situated on a line with the top of the sternum. In every instance also the face of the coin is turned forward. This should not be forgotten. In the case of a whistle of the small tin toy variety, the situation is the same and the application of the instrument for its removal is the same. It should be remembered that these foreign bodies may remain in this situation for a long time without discomfort, but that they do ultimately slough through and set up protracted coughing, causing death from a septic pneumonia, simulating phthisis. Before the introduction of the x-rays, many patients died without the cause having been discovered. The use of the x-rays now instantly determines the cause and saves the infliction of knife surgery.

ROENTGEN SOCIETY.

The following notice, made by Professor Monell, Chairman of Committee on Standards, appeals to all persons whomsoever that have any knowledge on this subject; and commends itself especially to medical men having interest in the attainment of more knowledge. Write to Dr. Monell and give expression on one or more of these subjects.

COMMITTEE ON STANDARDS.

DEAR SIR:

To promote uniformity in results and to secure accuracy and give legal value to the evidence of x-rays, it is necessary to standardize methods of doing the work. To this common benefit all x-ray experts are asked to contribute for the general good of the cause. You are therefore invited to write me your best suggestions on such of the following points as you can offer advice upon:

A standard uniform nomenclature for the principal terms required.

A standard form of record-blank for briefly filing reports and indicating all essential details of the exposure.

Standard of efficiency for tubes.

Qualities which a standard x-ray photographic plate should possess.

Qualities which a standard x-ray fluoroscope screen should possess.

Standard handle for all x-ray tubes so they will fit a standard tube-holder.

Standard tube-holder to fit uniform standard tube-handle—adjustable, rigid, holding tube without vibration—and convenient for general use.

Standard position of tube for correct shadow.

Standard distance of anode from plate for standard x-ray exposures.

Standard exposure times for chief parts of the body with a standard radiance.

Standard measure of different degrees of x-radiance.

Standard "skiameter."

Standard x-ray examination table, adjustable for all parts of the body.

Standard method of posturing each part of the body for a standard picture.

Standard means of fixing parts immovably during a standard exposure.

Standard complete definition of what a "standard exposure" should be. (Of medico-legal value.)

Standard land-marks to be pictured in the negative as inherent proof that a standard exposure was made—(a medico-legal necessity).

Standard method of localization for both "skiagraphy" and "fluoroscopy," which shall be the most practical, quick and uncomplicated.

Standard technique for picturing correct relation of bones and joints.

Standard technique for picturing details of any kind sought.

Standard technique for picturing contrast for diagnosis of soft parts.

Standard technique for picturing the different calculi, vesical, renal and gall-stones.

Standard technique for x-ray dental diagnosis.

Standard technique for x-ray eye work.

Standard technique for x-ray heart and lung diagnosis.

Standard treatment of plates to develop uniform results.

A standard leaflet of brief directions which the physician who does not do his own developing can send with his plates to any fair photographer as a ready guide to proper treatment of an x-ray negative to secure the picture.

Standard technique for therapeutic administration of x-rays with proper precautions.

You are invited to supply any omitted detail which you believe should be standardized. Will be pleased also to have you select one or more features of the above list in which you have had special experience and make a careful report upon what you regard as the proper standard to officially adopt. A reply is desired in about two weeks. In offering suggestions about standard working methods, postures, special devices, apparatus, etc., it is desirable that you send explana-

tory camera-photographs illustrating the details for comparison. Thanking you for your professional co-operation in behalf of the committee, I remain, Fraternally yours,

S. H. MONELL, M. D.,
Chairman of Committee on Standards.
47 West Twenty-seventh street, New York City.

SKIAGRAPHS ADMITTED IN COURT.

On April 9, in the United States Federal Court, at Chattanooga, Tenn., skiagraphs made by Prof. Horner, of Cleveland, Tenn., were admitted and ordered to be shown to the jury.

In the personal injury case of De Forge vs. The New York, New Haven & Hartford Railroad Co., the Supreme Court of Massachusetts remanded the findings of the lower court and orders the admission of evidence of an x-ray plate by the plaintiff.

It took a long time for the Jenner discovery to become popular. The greatest lights in the medical profession decried its use and many held to their views till death. Scarcely can a physician be found nowadays, so unlearned or untutored that vaccination is opposed by him. Owing to the telegraph, the rapid mail service, the press and other rapid methods of diffusing knowledge, the Roentgen rays will not be hindered through so many years with so many obstructionists. The conquering influence of the x-rays is already felt throughout the world, and the "sages of maturity" standing in the way, are brushed aside into a class of their own known as the "owls of old ways."

The discussion of the "inaccuracies of the x-rays" is always timely. It is so because this is a science with an applied art more useful in diagnostic medicine than any discovery in any previous century. But a physician has no professional or human right to discuss its inaccuracies unless he understands its accuracies. If he only knew the evil effects of morphine he would do well to let the drug alone and the entire profession of medicine. This is not a mooted question,

it is a simple question of education.

Those who have read THE AMERICAN X-RAY JOURNAL understandingly, since December last, inclusive, and the reports therein of the proceedings of the Roentgen Society of the United States, may have the satisfaction of knowing that they have the best and most useful information upon this great subject.

X-RAY LABORATORY.

The establishment of an x-ray laboratory in St. Louis has been expected for some time. It is strange that the location has not been sought before, since this is the home of THE AMERICAN X-RAY JOURNAL, the beginning or origin of the Roentgen Society of the United States and the fourth largest city in America.

There are several very good x-ray machines here and they are fairly well under the control of their respective operators, but in no instance have these workers prepared themselves to do the work the present stage of the science demands. The profession, the doctors of medicine as well as the doctors of surgery, require more than the simple flat shadow without detail. They want and must have a picture that will show more than the solid anatomy, more than the simple stone or bullet stripped of surrounding detail. They want and must have more than this. They must have some evidence of the correctness of the picture. This has not been done in St Louis except in the most limited sense. Again, the doctor wants a picture made without fuss and loss of time. When the patient is sent or accompanied by the doctor there should be no delay, and if the doctor desires to see the plate, it can be made ready for him in the dark room in a few minutes. Another thing presents itself very forcibly to every surgeon and often to physicians in the practice of medicine only—the use of the ray

at the bedside. It is found quite frequently very inconvenient, if not wholly inexpedient, to move the patient from the room. With the arrangements now being effected, all of these obstacles will be met.

Mr. M. E. Parberry has been directing his attention to the science of radiant matter, and of late of the practical uses of the x-rays. He is a young man of rare ability. Without stint of money he is fitting an x-ray laboratory in the Chemical Bld'g, St. Louis, certainly not surpassed for completeness in America. THE AMERICAN X-RAY JOURNAL congratulates him upon the location, the city, and the time, and bespeaks for him abundant success.

A good deal of money is required to establish such a laboratory, but we do not believe too many can be installed. They are in demand, and every city in the land should imitate this worthy effort. In Madrid, Spain, $50,000 was put in an x-ray laboratory following the Spanish-American War, and it has paid the investors. We are confident that Mr. Parberry will be handsomely rewarded.

Begin your subscription to THE AMERICAN X-RAY JOURNAL in Dec., 1900, and obtain all the matter of the Roentgen Society of the United States.

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